AC 150/5345-44F, Change 2

2/5/99

Subject: SPECIFICATION FOR TAXIWAY AND RUNWAY SIGNS

Initiated by: AAS-200

1. PURPOSE. This advisory circular (AC) contains the specification for lighted and unlighted signs to be used on taxiways and runways.

2. CANCELLATION. AC 150/5345-44F, Specification for Taxiway and Runway Signs, dated January 5, 1994 is cancelled.

3. APPLICATION. The standards contained herein are recommended by the Federal Aviation Administration (FAA) in all applications involving airport development of this nature. The standards are mandatory for projects funded under the airports grant program.

4. EXPLANATION OF CHANGE. The specification has been revised to include a specification for One-Half Distance Remaining Signs.

5. METRIC UNITS. To promote an orderly transition to metric units, the specification includes both English and metric dimensions. The metric conversions may not be exact equivalents and, until there is an official changeover to the metric system, the English dimensions will govern.

SIGNED BY:

David L. Bennett
Director, Office of Airport Safety and Standards

SPECIFICATION FOR TAXIWAY AND RUNWAY SIGNS

1. SCOPE AND CLASSIFICATION.

1.1 Scope. This specification contains the requirements for lighted and unlighted signs used on airport taxiways and runways.

1.2 Classification. Four types of signs may be specified in any of five sizes, five styles, and two classes, except as noted below.

1.2.1 Types. Signs of the following types are included:

Type L-858Y Direction, Destination, and Boundary signs - black legend on a yellow background

Type L-858R Mandatory Instruction sign - white legend on a red background

Type L-858L Taxiway and Runway Location signs - yellow legend and border on a black background

Type L-858B Runway Distance Remaining sign - white legend on a black background

Type L-858H-----One-Half Distance Remaining Sign – black legend and border on yellow background

1.2.2 Sizes. Signs of the following sizes are included:

Size 1 * 18-inch (460 mm) legend panel with a 12-inch (300 mm) legend

Size 2 * 24-inch (610 mm) legend panel with a 15-inch (380 mm) legend

Size 3 * 30-inch (760 mm) legend panel with an 18-inch (460 mm) legend

Size 4 ** 48-inch (1220 mm) legend panel with a 40-inch (1020 mm) legend

Size 5 ** 30-inch (760 mm) legend panel with a 25-inch (640 mm) legend

* Applicable only to Types L-858R, L-858Y, ~~and~~ L-858L, and L-858H.
** Applicable only to Type L-858B.

1.2.3 Styles. Signs of the following styles are included:

Style 1 Powered from a 120-volt AC power source.

Style 2 Powered from a series lighting circuit (4.8 to 6.6 amperes)

Style 3 Powered from a series lighting circuit (2.8 to 6.6 amperes or 8.5 to 20 amperes)

Style 4 Unlighted (Applicable only to Type L-858R, L-858Y, ~~and~~ L-858L, and L-858H.)

Style 5 Powered from a series lighting circuit (5.5 amperes)

1.2.4 Classes. Lighted signs of the following classes are included:

Class 1 For operation down to -4 degrees F (-20 degrees C)

Class 2 For operation down to -67 degrees F (-55 degrees C)

1.2.5 Modes. Unlighted signs of the following modes are included:

Mode 1 To withstand wind loads of 100 mph

Mode 2 To withstand wind loads of 200 mph

2. APPLICABLE DOCUMENTS.

2.1 General. The following documents are applicable to the extent specified in this AC.

2.2 Federal Aviation Administration (FAA) Advisory Circulars.

AC 150/5340-18 Standards for Airport Sign Systems

AC 150/5345-10 Specification L-828 Constant Current Regulator

AC 150/5345-26 Specification for L-823 Plug and Receptacle, Cable Connectors

AC 150/5345-42 Specification for Airport Light Base and Transformer Housings, Junction Boxes, and Accessories

AC 150/5345-47 Isolation Transformers for Airport Lighting Systems

2.3 American Society for Testing and Material (ASTM) Standard.

D 4956 Retroreflective Sheeting for Traffic Control, Specification for

2.4 Military Standard.

MIL-STD-810 Environmental Test Methods

2.5 Illuminating Engineering Society (IES).

IES LM-52 Calibration

(Copies of FAA advisory circulars may be obtained from the Department of Transportation, General Services Section, M-443.2, Washington, DC 20590)

(Copies of ASTM standards may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Copies of Military standards may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, PA 19120, Attention: Code CDS.)

(Copies of IES standards may be obtained from the Illuminating Engineering Society, 120 Wall Street, 17th Floor, New York, New York 10002.)

3. GENERAL REQUIREMENTS.

3.1 Equipment to be Supplied. Each sign shall meet all specification requirements and shall include mounting legs and hardware (4.1.2, 4.2, 5.1.3, 5.3). In addition, lighted signs shall include electrical disconnect (4.1.4.2), any required series circuit adapter unit (4.1.4.3) for Style 2, 3, and 5 signs, and two instruction booklets (4.7).

3.2 Environmental Requirements. The signs, including all required components, shall be designed for continuous outdoor use under the following conditions:

3.2.1 Temperature. An ambient temperature range from -4 degrees F (-20 degrees C) to +131 degrees F (+55 degrees C) for Class 1 signs and from -67 degrees F (-55 degrees C) to 131 degrees F (+55 degrees C) for Class 2 and Style 4 signs.

3.2.2 Wind. Exposure to wind velocities of 200 mph (322 km/h) for Style 1, 2, 3, 5 and Style 4, Mode 2 signs, and 100 mph (161 km/h) for Style 4, Mode 1, signs.

3.2.3 Rain. Exposure to driving rains.

3.2.4 Sunlight. Exposure to direct sunlight. (Applies to Style 4 signs only)

4. LIGHTED SIGNS. (Applies to Style 1, 2, 3, and 5 signs only)

4.1 Construction. The signs shall be constructed of lightweight, nonferrous materials and shall be designed for installation on a concrete pad or stakes. All required mounting hardware, except anchor bolts, shall be supplied with the sign.

4.1.1 Sizes. The dimensions of the signs shall be in accordance with Table 1. Sign lengths shall be chosen to accommodate only complete message elements. When required, a sign array may contain multiple signs of the same size (mounting height and face height) installed end-to-end on a straight line. When multiple signs are used, the separation distance between legend panels shall be 3 to 12 inches (76 to 305 mm). Internally and externally lighted signs shall not be installed in the same sign array. See Appendix 3 for examples of sign arrays.

Table 1. Sign Dimensions

Size	Legend Height		Legend Panel Height		Overall Mounting Height		Maximum Overall Length	
	Inches	mm	Inches	mm	Inches	mm	Inches	mm
1	12	300	18	460	24-30	610-760	120	3050
2	15	380	24	610	30-36	760-910	145	3690
3	18	460	30	760	36-42	910-1070	170	4290
4	40	1020	48	1220	54-60	1370-1520		
5	25	640	30	760	36-42	910-1070		

NOTE: Legend heights for Runway Safety Area/Obstacle Free Zone (OFZ) and Runway Approach Area Boundary; ILS Critical Area Boundary; and No Entry signs are specified in Appendix 2, Tables I, II, and III, respectively.

4.1.2 Mounting Legs. Mounting legs for each sign shall have frangible points located 2 inches (51 mm) or less above the concrete pad or stake. The frangible points shall withstand wind loads due to jet blasts of 200 mph (322 km/h) but will break before reaching an applied static load over the legend panel of 1.3 psi (8.96 kPa). Legend panels and panel supports shall withstand, at a minimum, that pressure at which the frangible points break.

4.1.3 Sign Faces. The signs may be either single face (message only on one side) or double face (messages on two sides). The sign faces shall have retroreflective material and shall meet the color and reflectivity
requirements of ASTM D 4956, Type I Sheeting. Retroreflective material, when installed, shall not be warped or wrinkled. The spacing, stroke, and shape of legend characters, numerals, and symbols shall be in accordance with Appendix 1 and 2 of this specification. Type L-858L sign faces shall have a margin and

a border in accordance with paragraphs 4.1.3.1 and as shown in Appendix 3, Figures 2 and 3. Message dividers shall be in accordance with paragraph 4.1.3.2.

4.1.3.1 Margin and Border for Type L-858L Signs. The sign faces of Type L-858L shall have a continuous border 13/16 inch (21 mm) wide for size 1; 1-1/16 inches (27 mm) wide for size 2; and 1-1/4 inches (32 mm) wide for size 3 signs. The border color shall be the same as that of the legend. The border shall be set in from the edge of the sign to yield a continuous margin 11/16 inch (17 mm) for Size 1; 1-7/16 inches for Size 2; and 2 inches for Size 3 signs. The horizontal distance from the edge of a character or numeral to
the inside edge of the border shall be as specified in Appendix 1, Table VII, for the appropriate sign size.

4.1.3.2 Message Dividers. Vertical message dividers shall be used to separate the message elements (e.g., ``C->", ``<-T->", ``15-APCH," etc.) of a sign array, as shown in Appendix 3, Figures 1, 2, and 4. Message dividers shall not be used to separate Type L-858L signs from Type L-858Y or Type L-858R signs when they are collocated. Message dividers shall be 1-5/16 inches (33 mm) in width for size 1; 1-11/16 inches (43 mm) for size 2; and 2 inches (51 mm) for size 3 signs. Message dividers shall extend from the top
to the bottom of the legend panel. Message divider color shall be the same as that of the legend.

4.1.4 Sign Power. Style 1, 2, 3, and 5 signs shall be internally lighted. Style 1 signs shall be designed for operation from a 120-volt AC power source. Style 2 signs shall be designed for operation from an airport series lighting circuit with a current range of 4.8 to 6.6 amperes. Style 3 signs shall be designed for operation from an airport series lighting circuit with a current range of 2.8 to 6.6 amperes or a current range of 8.5 to 20 amperes. Signs installed on a 20 ampere circuit should use an appropriate isolation transformer with a 6.6 ampere secondary. Style 2 and Style 3 signs shall meet the luminance requirements in 4.1.4.1 throughout the current range of the associated series circuit. Style 5 signs shall be designed for operation from an airport series lighting circuit with a current of 5.5 amperes. Style 5 signs shall be installed on a circuit, containing only these signs, which is powered with a three step regulator preset to 5.5 amperes output. The regulator control system shall be designed to meet the `Sign Operation" requirements provided in AC 150/5340-18C. Intensity control shall not be provided for Style 5 sign circuits.

4.1.4.1 Sign Luminance. The background of Type L-858Y signs and the legends of Type L-858R and L-858L signs shall have an average luminance of 10 to 30 ft lamberts. The sign type shall be readily identifiable up to a distance of 800 feet (244 m) when viewed during the day or when lighted at night. Lamps shall be easily accessible for replacement. Lamps used to illuminate signs shall be readily available from commercial electrical supply dealers. Style 2, 3, and 5 signs shall be compatible with all L-828 regulators, as specified in the latest edition of AC 150/5345-10.

4.1.4.2 Electrical Disconnect. All lighted signs shall be equipped with a power input disconnect cable terminated with a Type II plug, conforming to the requirement of AC 150/5345-26. The length of this cable shall permit the plug end to reach at least 6 inches (150 mm) below the top of the concrete pad or stake on which the sign is mounted. A cable clamp or similar restraining device shall be provided in the sign to prevent strain on the cable terminal connections when the cable plug is pulled apart. Power to the sign shall be provided through breakaway cable connectors installed within the frangible coupling portion of the sign's mounting legs. There shall be no above-ground electrical connection between signs in a sign array.

4.1.4.3 Style 2, Style 3 and Style 5 Signs. Signs designed for operation from a series lighting circuit shall be capable of being energized and operated at any current value of that system without flickering. Power input from the series lighting circuit shall be made through an isolation transformer of the proper rating, conforming to AC 150/5345-47. This transformer is not supplied with the sign. If the design requires power adapter circuitry for installation outside the sign, the circuitry shall be enclosed in a watertight container for installation in a transformer housing, conforming to AC 150/5345-42. The housing will not

be supplied with the sign, but the adapter unit shall be. This adapter unit shall be supplied with an output cable at least 24 inches (610 mm) in length and terminated with a Type II, Class A, Style 7 receptacle, conforming to AC 150/5345-26. If the isolation transformer is integral with the adapter unit, the power input leads shall be at least 24 inches (610 mm) in length, with one lead terminating in a Type I, Class A, Style 9 receptacle, conforming to AC 150/5345-26.

4.2 Materials and Components. All materials used in fabrication of the signs and mounting hardware shall be suitable for the signs' intended purpose and adequately protected against corrosion. All sign assembly hardware, including screws, bolts, nuts, washers, and latches, shall be 18-8 stainless steel. All wiring and components shall be adequately rated and shall not be operated in excess of the component manufacturer's recommended rating.

4.3 Finish. External surfaces of the signs, excluding the mounting legs and face panel, shall be painted with a primer coat and low luster, black, finish coat. The surface color treatment of the nonmetallic surfaces shall be equal in quality to that obtained on metal surfaces.

4.4 Nameplate. Each sign shall have a nameplate giving the Type, Size, Style, Class, manufacturer's name, address, catalog number, and lamp data, including type and rating. The nameplate on Style 1 signs shall give the total volt-amp load and power factor of the sign, including required ballasts, and/or adapter units. The nameplate on Style 2, 3 and 5 signs shall give the total maximum volt-amp load and power factor as seem from the primary of the isolation transformer. The total maximum volt-amp load indicated shall
reflect the highest possible volt-amp loading on the regulator and shall include loading due to a ``worst case'' isolation transformer, and any required ballasts and/or adapter units.

4.5 Frangible Couplings. Each frangible coupling shall be permanently marked with the manufacturer name (which may be abbreviated) and size of sign for which the coupling is intended.

4.6 Workmanship. The equipment shall be fabricated in accordance with the highest quality workmanship. All wiring shall be neatly run and laced. All sharp edges and burrs shall be removed. Painted surfaces shall be free from runs, blotches, and scratches.

4.7 Instruction Booklet. Two instruction booklets shall be included with each order of signs which shall include installation instructions, maintenance procedures, troubleshooting procedures (including operating voltage and point readings), and a complete parts list. It shall also describe the lamp voltage or current needed to maintain the luminance levels specified in 4.1.4.1.

4.8. QUALITY ASSURANCE PROVISION.

4.8.1 Qualification Procedures. Procedures for obtaining product certification for equipment to be furnished for Federal grant assistance programs at airports may be obtained from the Federal Aviation Administration, Office of Airport Safety and Standards, Attention: AAS-200, 800 Independence Avenue, SW, Washington, DC, 20591.4.8.2 Qualification Tests. All tests contained in 4.8.3, 4.8.4, and 4.8.5 are applicable for certification.

4.8.3 General Tests.

4.8.3.1 Visual Examination. For this test, Type L-858Y signs shall have at least two message elements separated by a message divider, Type L-858R signs shall have a legend which reads ``18- 36,'' and Type L-858L signs shall have a legend which reads ``B.'' The signs shall be examined for compliance with the requirements for dimensions, materials, component ratings, materials, finish, and quality of workmanship. Signs shall be viewed in daylight from a distance of 800 ft (244 m). The sign type, as defined in paragraph 1.2.1, should be readily identifiable. The sign face and retroreflective material shall

appear to be smooth and shall be free of any aberration (except at the panel joints of modular signs). Legend and/or background colors on modular signs shall be continuous across panel joints. Signs shall be viewed from a distance of 800 ft (244 m) at nighttime to determine if the luminance level is sufficient to make the Type L-858Y and L-858R background colors, and Type L-858L legend and border color readily discernible, or in the case of distance remaining signs to determine if the legend is readily discernible. Style 2 and Style 3 signs shall be viewed while the input current is varied throughout the range on which the sign is to operate. Modular signs shall then be viewed from a distance of 200 feet (61 m) with the sign at full brightness. The panel joints
shall not interfere with the legibility of the sign nor leak light which would cause a discontinuous color across the joint.

4.8.3.2 Wind Load and Frangibility Test. The signs shall be tested for their ability to withstand loads of 200 mph (322 km/h) without damage. The test shall be performed with sign completely assembled and mounted by the base assembly. If the loading is applied with the sign mounted on a vertical surface, the weight of the sign shall be included as part of the total applied weight. The test shall be designed to ensure the legend panel received the full load. Spring mounted signs designed to swing shall be locked to prevent
movement during the test. A static load of 0.9 psi (621 kPa) shall be applied uniformly over the entire surface of the legend panel for a period of 10 minutes. The sign shall not break at the frangible points nor suffer permanent distortion. The static load shall then be increased until the sign breaks at the frangible points. The breaking shall occur before the loading reaches an applied static load over the legend panel of 1.3 psi (8.96 kPa). The legend panel and panel supports shall then be inspected for evidence of damage. Any breakage or deformation shall be cause for rejection. Note: Spring mounted signs may alternatively be tested according to the procedure in 4.8.3.3.

4.8.3.3 Spring Mounted Signs. With the legend panel protected, the sign shall be tested for frangibility according to 4.8.3.2. The sign shall then be unlocked and subjected to Pbreak (the pressure at which the frangible points break). The sign face swing angle, phi, caused by the pressure, Pbreak, shall be measure. The pressure, Pswing, shall then be computed as follows: Pswing = Pbreak x (Cosine phi). With the sign relocked and the legend panel protection removed, the Pswing shall be applied uniformly over the entire surface of the legend panel for 1 minute. The legend panel and panel supports shall than be inspected for evidence of damage. Any breakage or deformation shall be cause for rejection.

4.8.4 Photometric Test.

4.8.4.1 Photometer Parameters. A foot-candle meter or telephotometer shall be used for this test. Before testing, photometric equipment shall be calibrated in accordance with IES LM-52. The foot-candle meter shall be calibrated to measure luminance and shall have a 6-inch (150 mm) long collimating luminance adapter tube (black on the inside) placed between the sign and the meter. The telephotometer shall be well color-corrected and calibrated to measure luminance. Either system shall be designed to measure a ``spot'' on the sign face of 1.5 inches (38.1 mm) in diameter. Light emitted only from the sign shall be permitted to reach either meter. Style 2 and Style 3 signs shall be tested at each input current throughout the range on
which the sign is to operate.

4.8.4.2 Sign Types and Sizes. Photometric testing shall be conducted on size 1, 2, and 3 for each of Type L-858Y, L-858R, and L-858L signs. If the luminaire design of a double face sign is symmetrical for both faces, then only one face should be tested. The length of Types L-858Y and L-858R to be tested shall be at least 45 inches (1140 mm). Signs employing modular construction shall contain at least two modules for this test.

4.8.4.3 Sign faces. Type L-858Y, ~~and~~ L-858L, and L-858H signs shall have an entirely yellow sign face made from the same material used to create the background on production L-858Y and l 858H signs or the legend and border on production L-858L signs, respectively. Type L-~~858~~R L-858B signs shall have an

entirely white sign face made from the same material used to create the legend on production L-858R signs.

4.8.4.4 Measurements. Measurements shall be made on a 3 inch (76 mm) grid over the entire face of the sign, with no measurement being closer than 3 inches (76 mm) to the sign frame. The average of all measurements shall fall between 10 and 30 ft lamberts. Adjacent measurements shall not exceed a 1.5:1 ratio.

4.8.4.5 Rain Test. A rain test shall be conducted for Style 1, 2, 3, and 5 signs in accordance with MIL-STD-810, Procedure I. The sign shall be operated during the last 10 minutes of the test. Failure of the sign to operate shall be cause for rejection. If water enters the sign during the test, the sign shall be designed to drain the water quickly and circuit components shall not be mounted below the water line. The presence of water inside the sign shall not change the electrical load of the sign.

4.8.4.6 Low Temperature Test. A low temperature test shall be conducted for the signs, including any required adapter units for lighted signs, in accordance with MIL-STD-810, Procedure I. The lowest operating temperature shall be -20 degrees C for Class 1 signs and -55 degrees C for Class 2. With the sign temperature stabilized at the lowest temperature, the sign face shall be inspected for any damage including cracking, peeling, delaminating, and flaking. This or any other structural damage of the equipment shall be cause for rejection. The sign shall be restabilized at the lowest temperature after examination.

4.8.4.7 High Temperature Test. A high temperature test shall be conducted for the signs, including any required adapter units for lighted signs, in accordance with MIL-STD-810, Procedure II. The maximum chamber temperature in Step 7 shall be +55 degrees C. This test shall immediately follow the low temperature test of 4.8.4.6. The high temperature chamber shall be preheated and stabilized at the maximum chamber temperature. The sign shall be transferred quickly from the low temperature chamber to the high temperature chamber. With the sign temperature stabilized at the maximum chamber temperature, the sign face shall be inspected for any damage including cracking, peeling bubbling delaminating, and flaking. This or any other structural damage of the equipment shall be cause for rejection. Failure of a
sign to operate shall also be cause for rejection. After the sign cools to ambient temperature, the sign face shall be reinspected. Any damage shall be cause for rejection.

4.8.4.8 Immersion Test. A water immersion test shall be performed on the adapter unit in accordance with MIL-STD-810, Procedure I. Evidence of water leakage shall be cause for failure. This test shall be conducted after the unit has been subjected to the high temperature test in 4.8.4.6 to ensure that the efficacy of the gasket material was not impaired.

4.8.5 Production Test. All production sign legend panels shall be inspected for compliance with all dimensions described herein. Retroreflective material shall appear to be smooth and be free of any aberration (except at the panel joints of modular signs). Panel joints of modular signs shall be observed to ensure that they not interfere with the legibility of the sign.

5. UNLIGHTED SIGNS (Applies to Style 4 signs only)

5.1 Construction. The sign panel shall be constructed of aluminum and shall be designed for installation on stakes or a concrete pad. All required mounting hardware, except anchor bolts, shall be supplied with the sign. Signs shall not be designed to swing.

5.1.1 Materials and Components. Panels shall be fabricated from aluminum sheets. The sheet shall be free from laminations, blisters, open seams, pits, holes, or other defects. The thickness shall be uniform and the blank commercially flat. Mounting hardware shall be suitable for the signs' intended purpose and

adequately protected against corrosion. All sign screws, bolts, nuts, and washers, shall be 18-8 stainless steel. Where applicable, an insulating material shall be placed to prevent contact between aluminum and steel material. Retroreflective material shall meet the color and reflectivity requirements of ASTM D4956, Type III or Type IV sheeting.

5.1.2 Sizes. The dimensions of the signs shall be in accordance with Table 2. Sign lengths shall be chosen to accommodate only complete message elements. When required, a sign array may contain multiple signs of the same size (mounting height and face height) installed end-to-end on a straight line. When multiple signs are used, the separation distance between legend panels shall be 3 to 6 inches (76 to 152 mm). See Appendix 4 for examples of sign arrays.

Table 2. Sign Dimensions

Size	Legend Height		Legend Panel Height		Overall Mounting Height		Maximum Overall Sign Length		Minimum Sign Length	
	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm
1	12	300	18	460	24-30	610-760	120	1524	30	762
2	15	380	24	610	30-36	760-910	145	1829	36	914
3	18	460	30	760	36-42	910-1070	170	2134	42	1067

NOTE: Legend heights for Runway Safety Area/Obstacle Free Zone (OFZ) and Runway Approach Area Boundary; ILS Critical Area Boundary; and No Entry signs are specified in Appendix 2, Tables I, II, and III, respectively.

5.1.3 Mounting Legs. Mounting legs for each sign shall have frangible points located 2 inches (51 mm) or less above the concrete pad or stake. The legs shall be mounted to the back of the sign, or in a manner which does not obstruct any portion of the sign front. The frangible points for mode 1 signs shall withstand wind loads due to jet blasts of 100 mph (161 km/h), but will break before reaching an applied static load over the legend panel of 0.9 psi (6.21 kPa). The mode 1 signs must withstand 100 mph winds and jet blast/prop wash from aircraft without bending or changing shape. The frangible points for mode 2 signs shall withstand wind loads due to jet blasts of 200 mph (322 km/h) but will break before reaching an applied static load over the legend panel of 1.3 psi (8.96 kPa). The mode 2 signs must withstand 200 mph winds and jet blast/prop wash from aircraft without bending or changing shape.

5.1.4 Sign Faces. The sign background, except for black, shall consist of retroreflective sheeting. The sheeting shall be applied to signs prepared in accordance with the recommendations of the retroreflective sheeting manufacturer. The sign panel with the sheeting shall be finished, free of cracks, wrinkles, blisters, and warps, and shall present a smooth surface of uniform color. All units of the sign message shall be formed to provide a continuous stroke width with smooth edges and shall present a flat surface free from warps, blisters, wrinkles, and burrs. The background and legend color shall be as specified for each type of sign. The sign face shall be constructed by the direct applied characters process or the screen process in

accordance with 5.1.4.1 and 5.1.4.2, respectively. The spacing, stroke, and shape of legend characters, numerals, and symbols shall be in accordance with Appendix 1 and 2 of this specification. Type L-858L sign faces shall have a margin and a border in accordance with paragraphs 5.1.4.3 and as shown in Appendix 4, Figures 1 and 2. Message dividers shall be in accordance with paragraph 5.1.4.4. Corners of sign faces shall be rounded to a radius of 1-1/2 inches +/- 1/8".

5.1.4.1 Direct Applied Character Process. Letters, numerals, symbols and border of the sign shall be cut from retroreflective sheeting and shall be applied in accordance with the manufacturers recommendations.

5.1.4.2 Screen Process. Letters, numerals, symbols, and border of sign shall be applied to the retroreflective sheeting or opaque background of sign by direct or reverse screening. The sign message for Type L-858Y shall be applied to retroreflective sheeting by direct screening process. Sign message for Type L-858L and Type L-858R shall be produced by the reverse screening process.

5.1.4.3 Margin and Border for Type L-858L and Type L-858H Signs. The sign faces of Type L-858L and Type l-858H signs shall have a continuous border 12/16 inch (21 mm) wide for Size 1; 1-1/16 inches (27 mm) wide for Size 2; and 1-1/4 inches (32 mm) wide for Size 3 signs. The border shall be the same color as the legend. The border shall be set in from the edge of the sign to yield a continuous margin 11/16 inch (17 mm) for Size 1; 1-7/16 inches for Size 2; and 2 inches for Size 3 signs. The horizontal distance from the edge of a character or numeral to the inside edge of the border shall be as specified in Appendix 1, Table VIII, for the appropriate sign size. This distance may be increased, if necessary, to meet the minimum sign length specified in Table 2. The border shall be square at each corner of the sign (see Corner Detail, Appendix 4, Figure 2).

5.1.4.4 Message Dividers. Vertical message dividers shall be used to separate the message elements (e.g., ``C->", ``<-T->", ``15-APCH", etc.) of a sign array, as shown in Appendix 3, Figures 1, 2, and 4. Message
dividers shall not be used to separate Type L-858L signs from Type L-858Y or Type L-858R signs when they are collocated. Message dividers shall be 1-5/16 inches (33 mm) in width for size 1; 1-11/16 inches (43 mm) for size 2; and 2 inches (51 mm) for size 3 signs. Message dividers shall extend from the top to the bottom of the legend panel. Message divider color shall be the same as that of the legend.

5.2 Finish. The back panel of the sign shall be painted with a primer coat and low luster, flat black, finish coat or covered with black scotch cal sheeting.

5.3 Frangible couplings. Each frangible coupling shall be permanently marked with the manufacturer name (which may be abbreviated) and size of sign for which the coupling is intended.

5.4 Workmanship. The sign shall be fabricated such that all sharp edges and burrs are removed. Painted surfaces shall be free from runs, blotches, and scratches.

5.5 Instruction Guide. An instruction guide, with sign installation details and a parts list, shall be included with each order of signs.

5.6 QUALITY ASSURANCE PROVISION. In order to be eligible for installation under the Airports grant program, manufacturers of unlighted signs are required to furnish proof from a testing laboratory to the airport owner, or the owner's representative, that the sign conforms to the following provisions:

5.6.1 Guarantee. The manufacturer shall agree to provide each customer with the following guarantee. The sign has been manufactured in accordance with the specification and any defect in material or workmanship which may occur within 2 years from installation will be corrected or replaced by the manufacturer at no cost to the airport owner.

5.6.2 Tests.

5.6.2.1 Visual Inspection. For this test, Type L-858Y signs shall have at least two message elements separated by a message divider; Type L-858R signs shall have a legend which reads ``18-36''; and Type L-858L signs shall have a legend which reads, e.g., ``B'' . The signs shall be examined for compliance with the requirements for dimensions, materials, finish, and quality of workmanship. The signs shall be viewed in daylight and at nighttime from a distance of 800 ft (244 m). The sign type, as defined in paragraph 1.2.1, should be readily identifiable. The sign face and retroreflective material shall appear to be smooth and shall be free of any aberration (excepting minor seams between retroreflective sheets) and sharp edges.

5.6.2.2 Wind Load and Frangibility Test. The signs shall be tested for their ability to withstand loads of 100 mph (161 km/h) for mode 1 and 200 (322 km/h) for mode 2 without damage. The test shall be performed with the sign completely assembled and mounted by the base. If the loading is applied with the sign mounted on a vertical surface, the weight of the sign shall be included as part of the total applied weight. The test shall be designed to ensure the legend panel receives the full load. A static load of .23 psi
(1.59 kPA) for mode 1 and .9 psi (6.21 kPa) for mode 2 shall be applied uniformly over the entire surface of the legend panel for a period of 10 minutes. The sign shall not break at the frangible points nor suffer permanent distortion. The static load shall then be increased until the sign breaks at the frangible points. The breaking shall occur before the loading reaches an applied static load over the legend panel of .9 psi (6.21 kPa) for mode 1 and 1.3 (8.96 kPa) for mode 2. The legend panel and panel supports shall then be inspected for evidence of damage. Any breakage or permanent deformation shall be cause for rejection.

5.6.2.3 Low Temperature Test. Signs shall be subjected to a temperature of -67 degrees F (-55 degreesC) (+/-2) for a period of 24 hours. Evidence of any damage including cracking, peeling, bubbling, delaminating, and flaking, shall be cause for rejection.

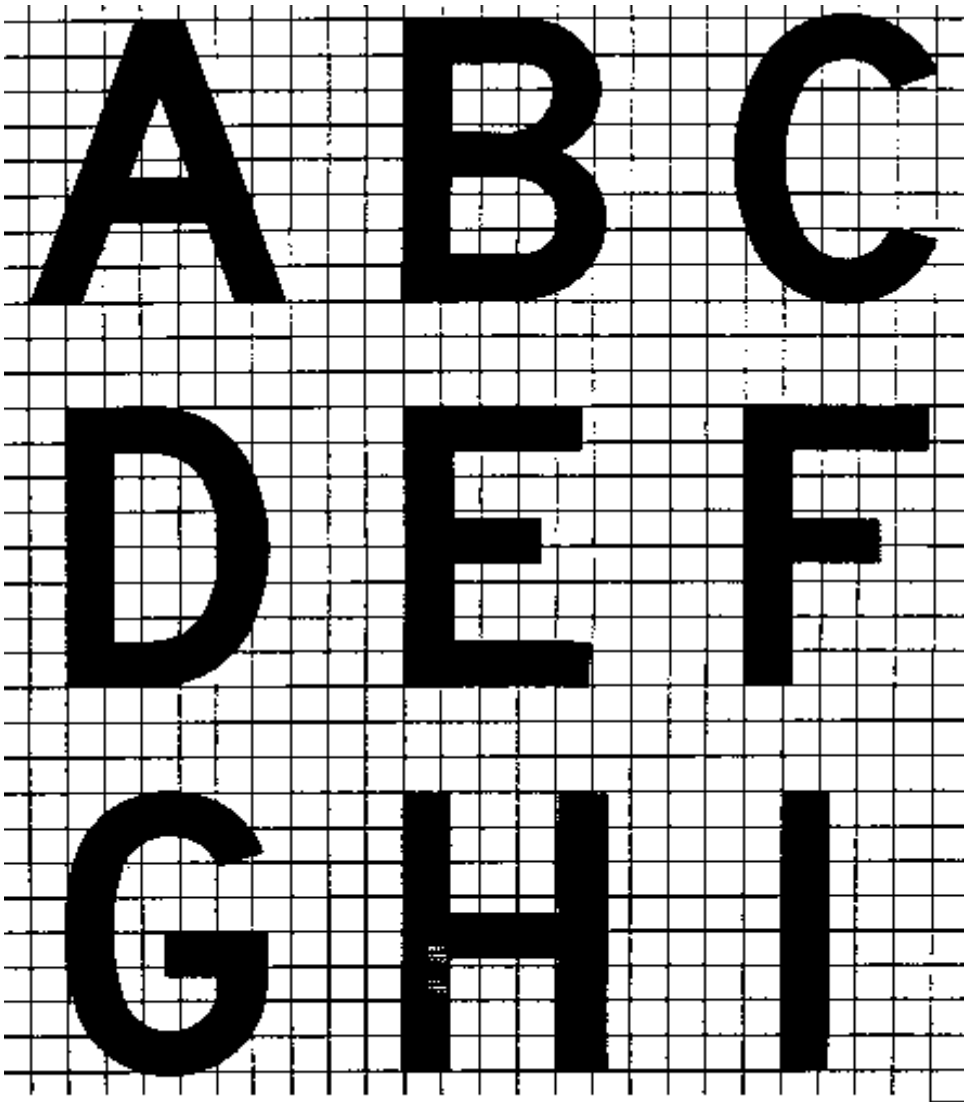
5.6.2.4 High Temperature Test. Signs shall be subject to a temperature of 131 degrees F (55 degrees C) for a period of not less than 7 hours. Evidence of any damage including cracking, peeling, bubbling, delaminating, and flaking, either during test of after cooling shall be cause for rejection.

5.6.2.5 Solar Radiation. A sunshine test shall be conducted in accordance with MIL-STD-810, Method 505.2, Procedure. The sign shall be subjected to a minimun of five cycles. At the conclusion of the test, any evidence of cracking peeling, bubbling, flaking, delaminating or corrosion shall be cause for rejection.

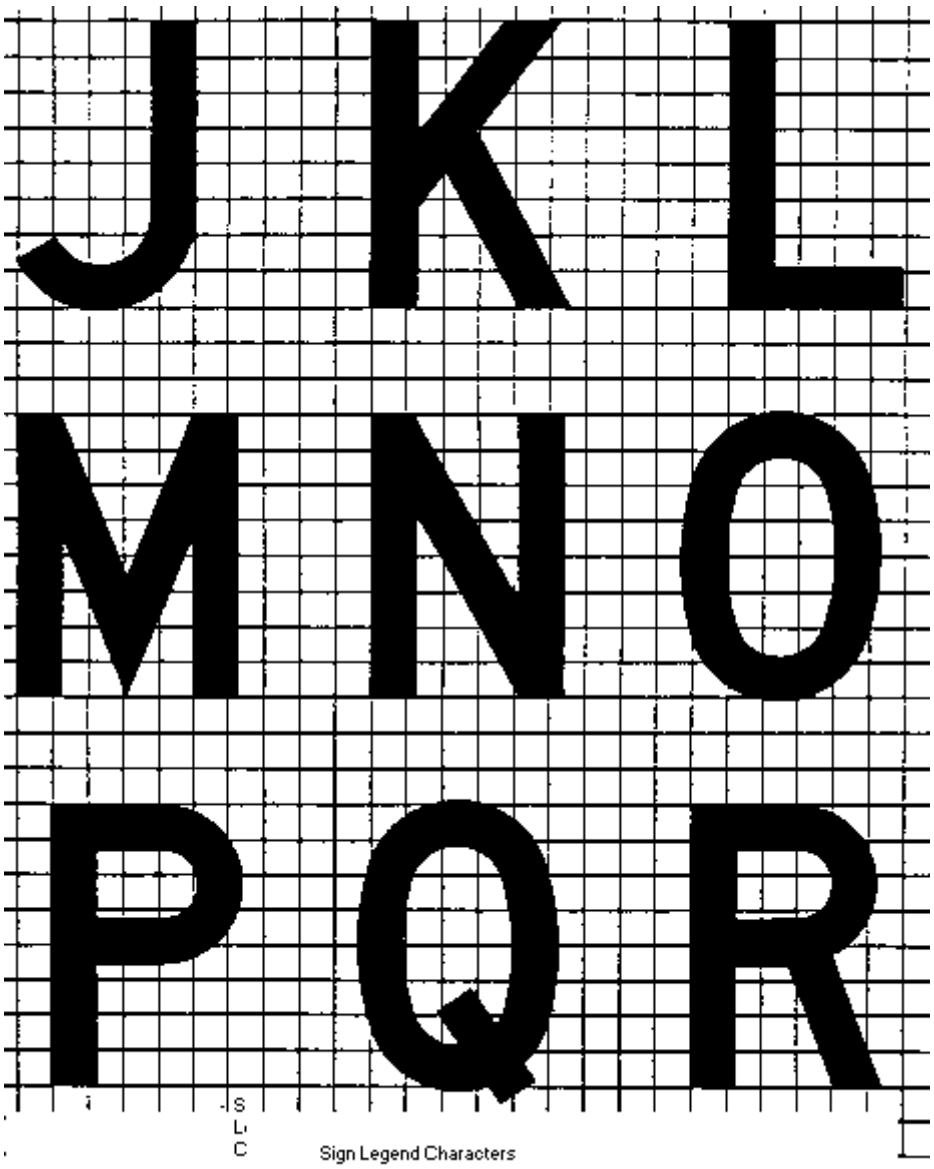
5.6.2.6 Production Testing. All production sign legend panels shall be inspected for compliance equirements for dimensions, materials, finish, and quality of workmanship. Retroreflective material shall be inspected to ensure that it is smooth and free from aberration.

APPENDIX 1 - INSCRIPTIONS FOR SIGN FACES

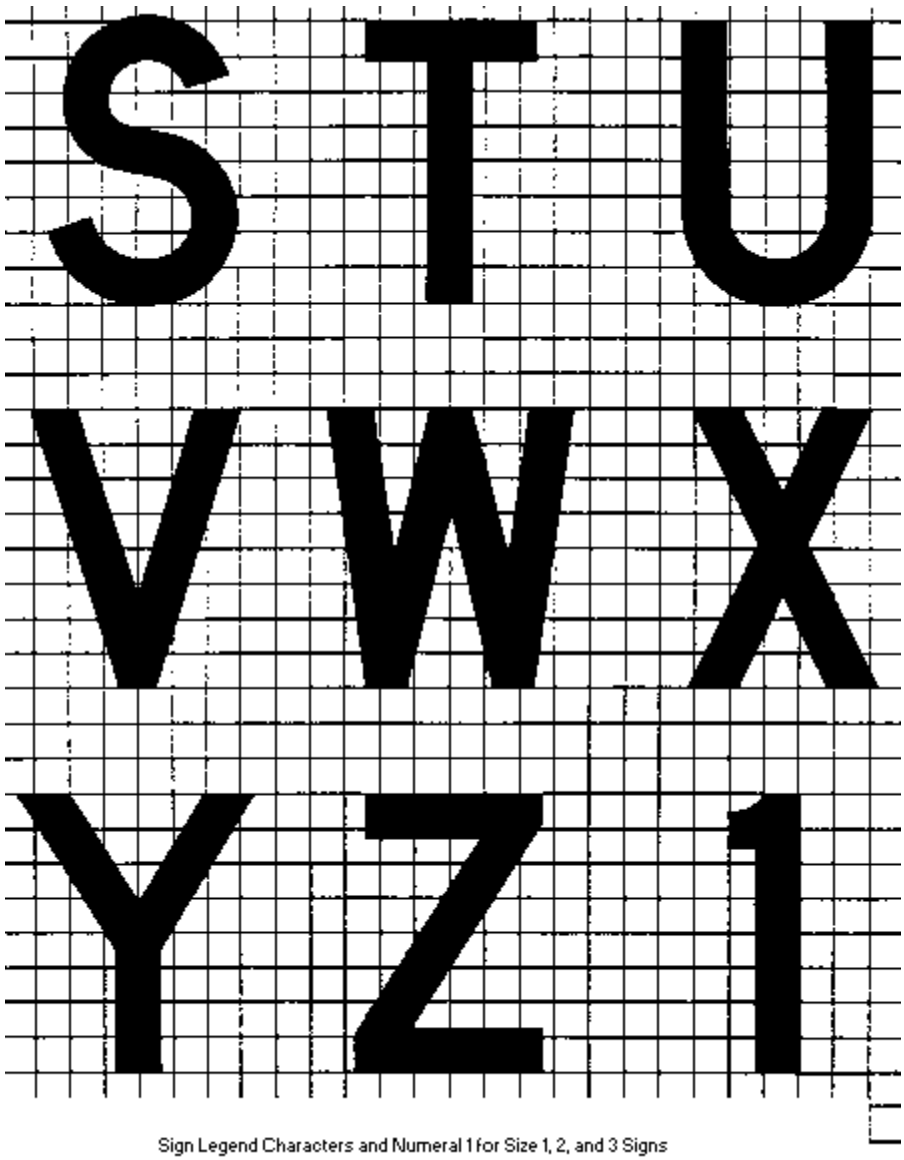
This Appendix shows the shapes of the letters, numbers, and symbols used in inscriptions for sign faces.



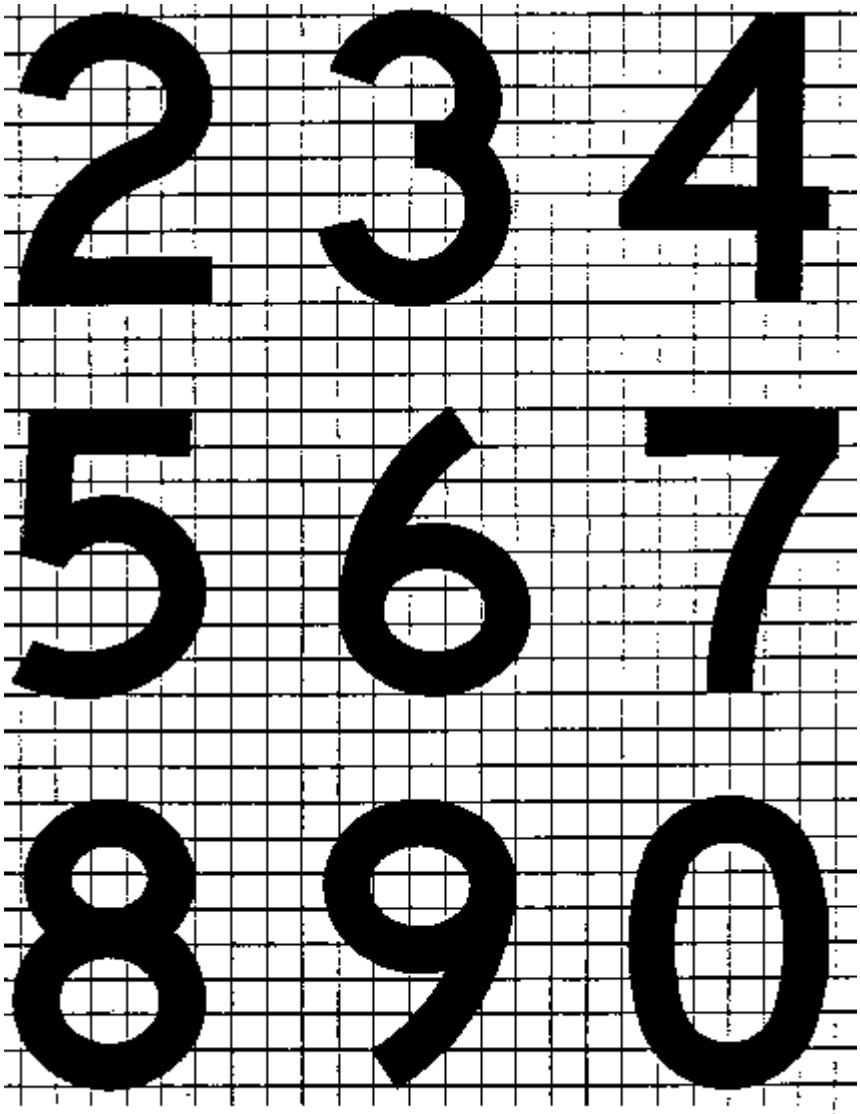
Sign Legend Characters



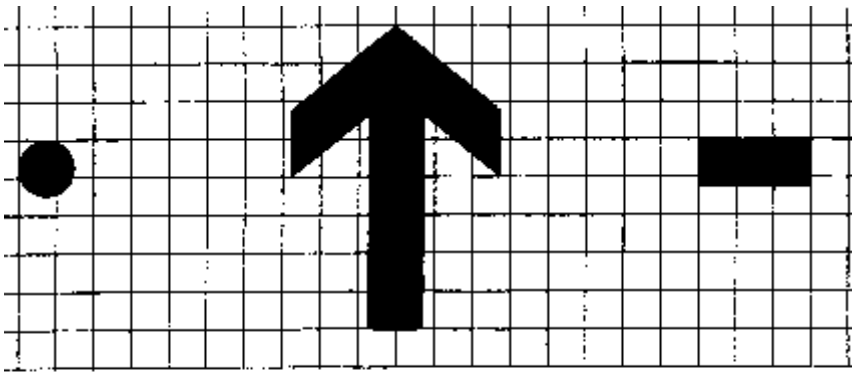
Sign Legend Characters



Sign Legend Characters and Numeral 1 for Size 1, 2, and 3 Signs



Numerals for Size 1, 2, and 3 Signs



(a) The arrow stroke width, diameter of the dot, and both width and length of the dash, shall be proportional to the character stroke widths as defined by Table III.

(b) the dimensions of the arrow shall remain constant for a particular sign size, regardless of orientation.

NOTE: The minimum spacing between a letter or numeral and a dash or dot shall be 4 inches.

TABLE I
LETTER TO LETTER CODE NUMBER
Following Letter

Preceding Letter	"B,D,E,F" "H,I,K,L,M," "N,P,R,U"	"C,G,O,Q," "S,X,Z"	"A,J,T," "V,W,Y"
A	2	2	4
B	1	2	2
C	2	2	3
D	1	2	2
E	2	2	3
F	2	2	3
G	1	2	2
H	1	1	2
I	1	1	2
J	1	1	2
K	2	2	3
L	2	2	4
M	1	1	2
N	1	1	2
O	1	1	2
P	1	2	2
R	1	2	2
S	1	2	2
T	2	2	4
U	1	1	2
V	2	2	4
W	2	2	4
X	2	2	3
Y	2	2	4
Z	2	2	3

TABLE II
NUMERAL TO NUMERAL CODE NUMBER
Following Numeral

Preceding Letter	"1,5"	"2,3,6" "8,9,0"	"4,7"
1	1	1	2
2	1	2	2
3	1	2	2
4	2	2	4
5	1	2	2
6	1	2	2
7	2	2	4
8	1	2	2
9	1	2	2
0	1	2	2

To determine the property space between letters or numerals, obtain the code number from Table I or II and enter Table VI for that code number to the desired letter or numeral height.

TABLE III, WIDTH OF STROKES

Letter Height (in)	(mm)	Stroke Width (in)	(mm)
12	304.8	1.88	47.8
15	381.0	2.35	59.7
18	457.2	2.81	71.4
25	635.0	3.53	89.5
40	1000.0	5.64	143.3

TABLE IV, WIDTH OF LETTERS

Letter Height

	12in (300mm)		15in (380mm)		18in (460mm)	
	in	mm	in	mm	in	mm
A	10.03	254.8	12.55	318.8	15.06	382.5
B	8.06	204.7	10.08	256.0	12.09	307.1
C	8.06	204.7	10.08	256.0	12.09	307.1
D	8.06	204.7	10.08	256.0	12.09	307.1
E	7.31	185.7	9.14	232.2	10.97	278.6
F	7.31	185.7	9.14	232.2	10.97	278.6
G	8.06	204.7	10.08	256.0	12.09	307.1
H	8.06	204.7	10.08	256.0	12.09	307.1
I	1.88	47.8	2.35	59.7	2.81	71.4
J	7.50	190.5	9.38	238.3	11.25	285.8
K	8.25	209.6	10.32	262.1	13.38	314.5
L	7.31	185.7	9.14	232.2	10.97	278.6

M	9.28	235.7	11.61	294.9	13.94	354.1
N	8.06	204.7	10.08	256.0	12.09	307.1
O	8.44	214.4	10.55	268.0	12.66	321.6
P	8.06	204.7	10.08	256.0	12.09	307.1
Q	8.44	214.4	10.55	268.0	12.66	321.6
R	8.06	204.7	10.08	256.0	12.09	307.1
S	8.06	204.7	10.08	256.0	12.09	307.1
T	7.31	185.7	9.14	232.2	10.97	278.6
U	8.06	204.7	10.08	256.0	12.09	307.1
V	9.00	228.6	11.25	285.8	13.50	342.9
W	10.50	266.7	13.13	333.5	15.75	400.1
X	8.06	204.7	10.08	256.0	12.09	307.1
Y	10.12	257.0	12.66	321.6	15.19	385.8
Z	8.06	204.7	10.08	256.0	12.09	307.1

TABLE V, WIDTH OF NUMERALS

Numeral Height

	12 in (300 mm)		15 in (380 mm)		18 in (460 mm)		25 in (635 mm)		40 in (1000 mm)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
1	2.91	73.9	3.65	92.5	4.38	111.3	5.08	129.0	8.12	206.2
2	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
3	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
4	8.81	223.8	11.02	279.9	13.22	335.8	15.23	386.8	24.36	618.7
5	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
6	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
7	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
8	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
9	8.06	204.7	10.08	256.0	12.09	307.1	13.70	348.0	21.88	555.8
0	8.44	214.4	10.55	268.0	12.66	321.6	14.40	365.0	23.12	587.2

TABLE VI, LETTER AND NUMERAL SPACING

Space measured horizontally from the extreme right edge of the preceding letter or numeral to the extreme left edge of the followinng letter or numeral.

Letter or Numeral Height

Code * Number	12 in (300 mm)		15 in (380 mm)		18 in (460 mm)		25 in (635 mm)		40 in (1000 mm)	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)	(in)	(mm)
1	2.81	71.4	3.52	89.4	4.22	107.2	5.14	130.6	8.22	208.8
2	2.25	57.2	2.82	71.6	3.38	85.9	4.23	107.4	6.76	171.7
3	1.50	38.1	1.88	47.8	2.25	57.2	3.03	77.0	4.84	122.9
4	0.75	19.1	0.94	23.9	1.12	28.4	1.40	35.6	2.24	56.9

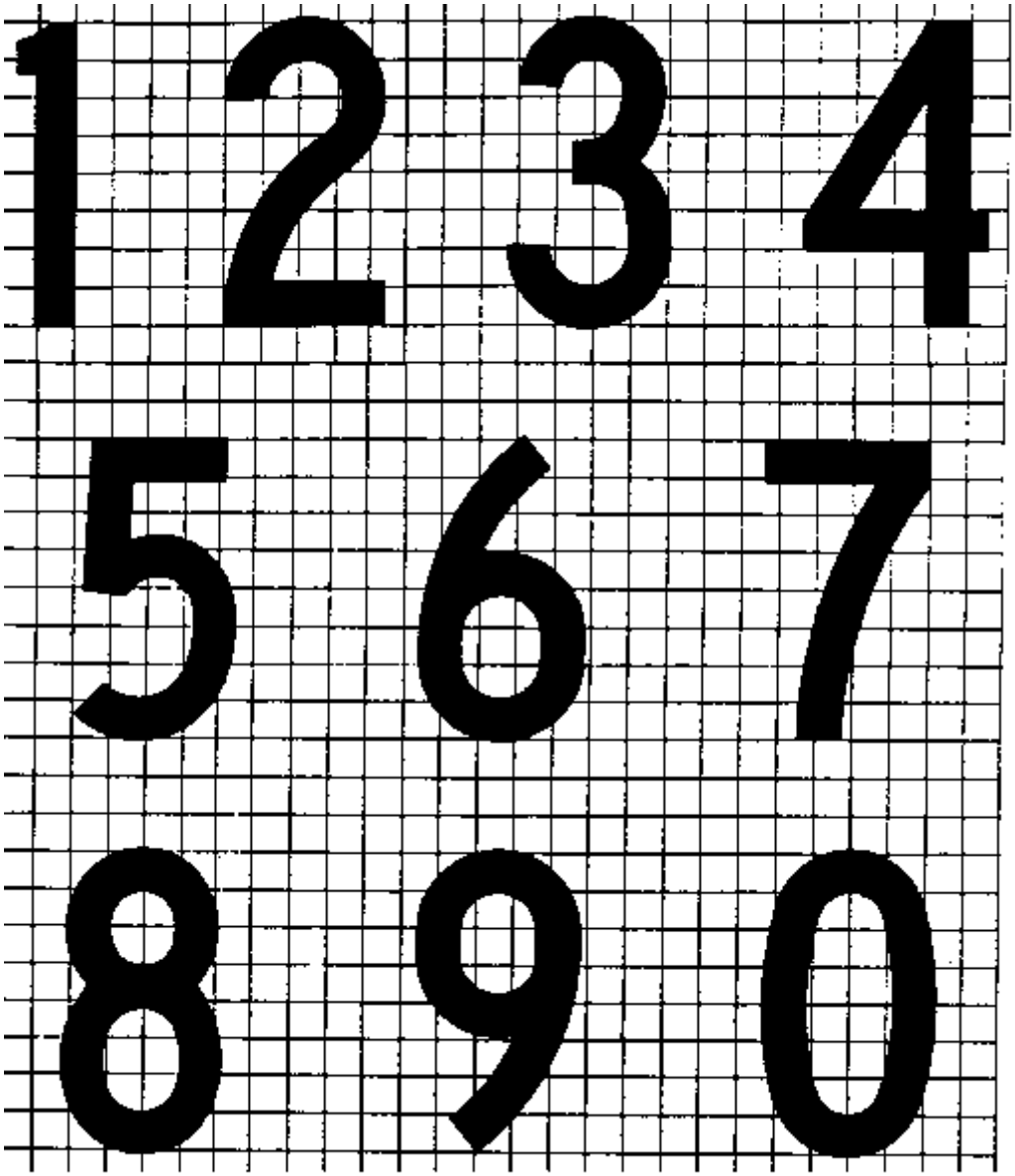
* See Table I or III

TABLE VII, SPACING FOR BORDERS AND MESSAGE DIVIDERS (LIGHTED SIGNS)

	in	mm	in	mm	in	mm	in	mm	in	mm
Letter or Number Height	12	300	15	380	18	460	25	640	40	1020
Minimum Spacing between Legend andBorder (or Sign Edge, if no Border)	1.50	38.1	2.00	50.8	2.50	63.5	3.00	76.2	4.00	101.6
Horizontal Spacing Between Legend and Border for Type L-858L, Taxiway Location Signs, which contain a single character	3.00	76.2	3.50	88.9	4.00	101.6	N/A		N/A	
Horizontal Spacing Between Legend and Border (or Sign Edge, if no Border) for Types L-858R or L-858L, Runway Location Signs, which contain a single digit	6.00	152.4	6.50	165.1	7.00	177.8	N/A		N/A	
Minimum Spacing Between Legend and Message Divider	3.00	76.2	3.50	88.9	4.00	101.6	N/A		N/A	

TABLE VII, SPACING FOR BORDERS AND MESSAGE DIVIDERS (UNLIGHTED SIGNS)

	in	mm	in	mm	in	mm
Letter or Number Height	12	300	15	380	18	460
Minimum Spacing between Legend and Border (or Sign Edge, if no Border)	1.50	38.1	2.00	50.8	2.50	63.5
Horizontal Spacing Between Legend and Border for Type L-858L, Taxiway Location Signs, which contain a single character	3.00	76.2	3.50	88.9	4.00	101.6
Horizontal Spacing Between Legend and Border (or Sign Edge, if no Border) for Types L-858R or L-858L, Runway Location Signs, which contain a single digit	6.00	152.4	6.50	165.1	7.00	177.8
Minimum Spacing Between Legend and Message Divider	3.00	76.2	3.50	88.9	4.00	101.6



Numerals for Size 4 and 5 Signs

APPENDIX 2 - SIGN LEGENDS

This Appendix shows the dimensions for runway safety area/OFZ, runway approach boundary, ILS critical area, and no entry sign.

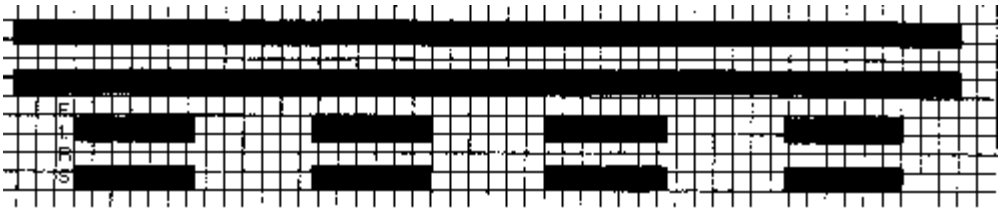


Figure 1. Runway Safety Zone/OFZ and Runway Approach Boundary Sign

TABLE I. DIMENSIONS FOR RUNWAY SAFETY AREA/OFZ AND RUNWAY APPROACH BOUNDARY SIGNS

	Size 1		Size 2		Size 3	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
Legend Height	9.0	228.8	12.0	304.8	15.0	381.0
Length Length	57.5	1460.5	73.0	1854.2	84.0	2133.6
Stroke Width	1.29	32.8	1.72	43.7	2.14	54.4
Dash Length	7.18	182.4	9.12	231.6	10.5	266.7

(a) Legend length may vary +/- 2 inches (50.8).
(b) Vertical spacing between bars shall be equal to the stroke width.
(c) Horizontal spacing between dashes shall be equal to the dash length.
(d) Dash length and horizontal spacing shall vary proportionally to legend length.
(e) The yellow background of the boundary sign should not extend beyond the ends of the solid horizontal bars.

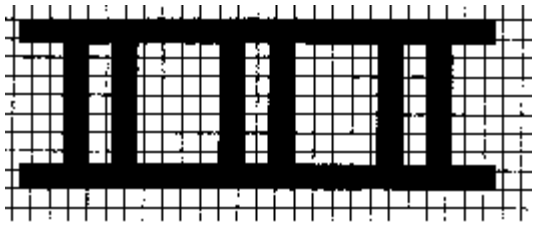


Figure 2. ILS Critical Area Boundary Sign

TABLE II. DIMENSIONS FOR ILS CRITICAL AREA BOUNDARY SIGNS

	Size 1		Size 2		Size 3	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
Legend Height	9.0	228.6	12.0	304.8	15.0	381.0
Legend Length	30.0	762.0	36.0	914.4	42.0	1066.8
Stroke Width	1.29	32.8	1.72	43.7	2.14	54.4

(a) Legend length may vary +/- 2 inches (50.8).
(b) The space within a pair of vertical bars shall be equal to the stroke width.
(c) The space between each pair of vertical bars shall vary proportionally to legend length.
(d) The yellow background of the boundary signs should not extend beyond the ends of the horizontal bars.

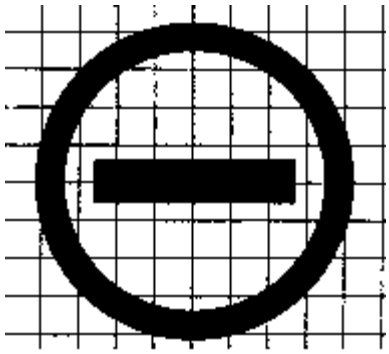


Figure 3. No Entry Sign

TABLE III. DIMENSIONS FOR NO ENTRY SIGNS

	Size 1		Size 2		Size 3	
	(in)	(mm)	(in)	(mm)	(in)	(mm)
Minimum Legend Panel Length	24.0	609.6	32.0	812.8	40.0	1016.0
Outer Radius	7.35	186.7	9.75	247.7	12.2	309.9
Inner Radius	6.05	153.7	7.95	201.9	10.0	254.0
Dash Length	9.3	236.2	12.4	315.0	15.5	393.7
Dash Width	2.0	50.8	2.7	68.6	3.3	83.8

APPENDIX 3 - SIGN ARRAYS (LIGHTED SIGNS)

This Appendix represents typical installations of signs containing multiple message elements and sign types.

Figure 1. Type L-858Y Direction Sign array which contains three message elements separated by message dividers. On modular signs, the message dividers may be coincident with panel joints. Figure not drawn to scale.

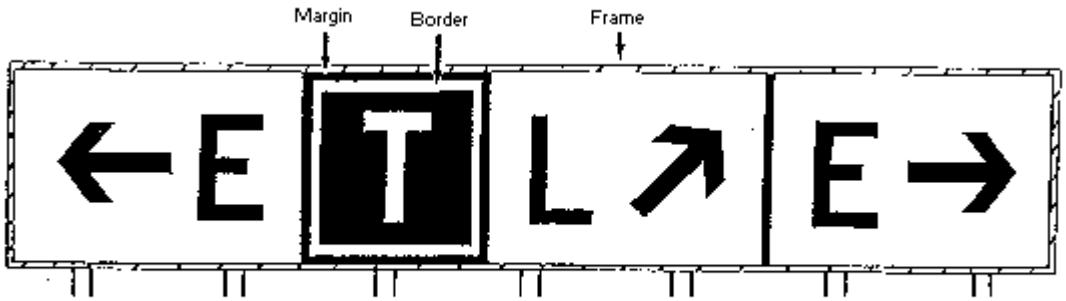


Figure 2. Sign array which contains two type L-858Y Direction Signs separated by a Type L-858L Taxiway Location Sign. The Type L-858Y sign on the right contains two message elements separated by a message divider. Figure not drawn to scale.

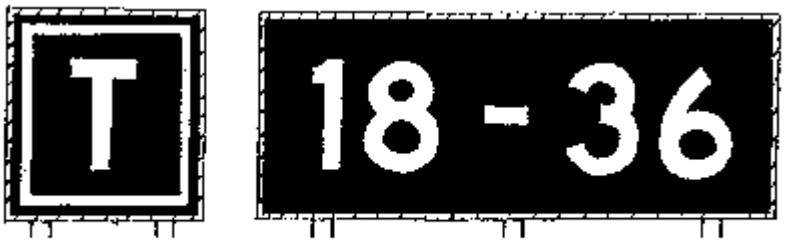


Figure 3. Sign array (made up of multiple signs) which contains a Type L-858L Taxiway Location Sign and an L-858R Runway Holding Position Sign. Figure not drawn to scale.

Figure 4. Type L-858R sign array which contains two message elements.

APPENDIX 4 - SIGN ARRAYS (UNLIGHTED SIGNS)

This Appendix represents typical installations of signs containing multiple message elements and sign types.

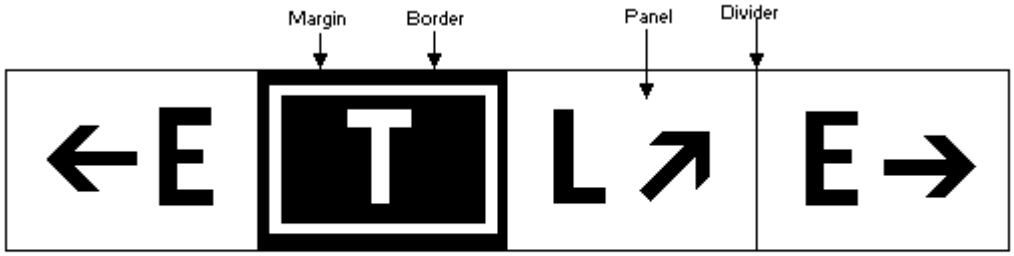
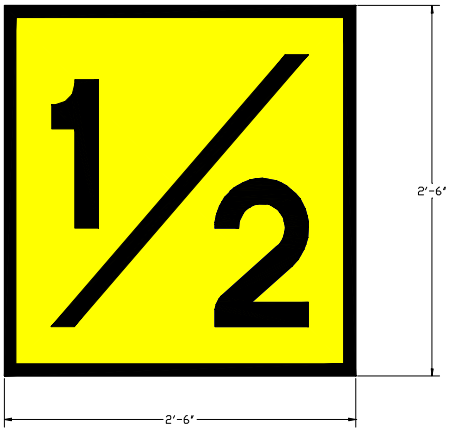


Figure 1. Sign array which contains two type L-858Y Direction Signs separated by a Type L-858L Taxiway Locaton Sign. The Type L-858Y sign on the right contains two message elements separated by a message divider. Figure not drawn to scale.

Figure 2. Sign array (made up of multiple signs) which contains a Type L-858L Taxiway Location Sign and an L-858R Runway Holding Position Sign. Figure not drawn to scale.



One-Half Distance Remaining Sign